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Association of Risk Factors with Female Pattern Hair Loss

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Abstract

Introduction: *Female Pattern Hair Loss (FPHL) is one of the main causes of hair loss in adult women and has a major impact on individual's quality of life. It evolves from the progressive miniaturization of follicles that lead to a subsequent decrease of the hair density, leading to a non-scarring diffuse alopecia. In spite of the high frequency of the disease and the relevance of its psychological impact, its pathogenesis is not yet fully understood, being influenced by genetic, hormonal, and environmental factors.* ***Objective:*** *To evaluate etiological factors associated with female pattern hair loss.* ***Materials & Methods:*** *This was a hospital-based case control study, conducted in the Department of Dermatology & Venereology, Bangabandhu Sheikh Mujib Medical University (BSMMU) from March, 2021 to August, 2022. In this study, total 100 females aged 18 to 45 years were enrolled. Among them, 30 females had history of hair loss >6 months, presented to outpatient department, BSMMU were included as case & 70 healthy females who had no history of hair loss included as control according to inclusion & exclusion criteria. Diagnosis of FPHL was made clinically & Ludwig classifications were used to assess the degree of hair loss. Information on possible risk factors for FPHL was collected using a questionnaire interview.* ***Result:*** *The mean age of the patients with FPHL was 41.0±7.77 years with majority belongs to >40 years of age group & their mean duration of hair loss was 26.3±12.0 months. Among the patients of FPHL, 36.7% had history of inadequate intake of iron containing food, 66.7% had family history of alopecia, 36.7% had history of increased bleeding during their menstruation, 20.0% had multiple (>3) childbirth & 23.3% had hypertension. About 86.7% patients with FPHL had low serum ferritin (<30ng/ml) with mean serum ferritin level was 20.25±16.07ng/ml and 66.7% patients of FPHL had low Hb (<12 µg/l) with mean Hb was 11.47±1.52 µg/l. In the multivariate logistic regression analysis significant association found with FPHL were age (OR 2.013, 95% CI 0.672-3.714), family history of alopecia (OR1.231, 95% CI 0.162-1.991) and lower serum ferritin level (OR1.090, 95% CI 1.043-1.139).* ***Conclusion:*** *Age, family history of alopecia, lower serum ferritin may be implicated as risk factors for female pattern hair loss.*

Key words: *Female pattern hair loss, risk factors, serum ferritin level.*

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Introduction:

Female pattern hair loss (FPHL) is nonscarring progressive thinning of hair with gradual decrease in the number of hairs, especially in the frontal, central, and parietal scalp, due to a process known as follicular miniaturization with characteristic clinical, dermoscopic and histological patterns. The etiopathogenesis of FPHL is complex with multiple factors such as genetics, inflammation, hormones, and environment[1]. The prevalence of FPHL is known to differ among races and the prevalence increases with advancing age. The prevalence of FPHL has been reported to be 19% in Caucasian women & reportedly less common in Asian women[2]. The age of onset is usually the 3rd and 4th decades, but the hair loss starts immediately after puberty and continues progressively[3]. In 2005, an Australian study found 13% prevalence in the third decade of life, & a 54% prevalence in the eighth decade of life[4]. A study conducted at Bangladesh in 2006 found 50% patients with FPHL was at 20-30 years of age . In the female pattern, there is a diffuse thinning while the frontal hairline is preserved[3]. The vible thinning of hair of the scalp in FPHL results from a progressive decrease in the ratio of the terminal (large, thick, pigmented) to vellus like hair (short, thin, nonpigmented) a process known as follicular miniaturization. The mechanism through which this follicular transformation occurs in FPHL

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is uncertain[6]. Premature termination of the anagen phase is the key event in the development of FPHL[1]. The etiopathogenesis of FPHL is complex. Hair loss in women is polygenic & multifactorial and both androgen-dependent and androgen-independent mechanisms contribute with the influence of environmental factors[2]. The role of androgens in the development of FPHL is not yet clear. In fact, FPHL occurs in some females with normal levels of circulating androgens. Several environmental factors possibly related to FPHL are psychological stress, hypertension, diabetes mellitus, smoking, multiple marriages, lack of photoprotection, higher income, minimal physical activity, obesity, and lower serum ferritin level[1].

Despite of many studies addressing risk factors associated with FPHL with a controversial re sult, there is a paucity of data in our country. Thus, the objective of this study was to investigate the association between potential risk factors (Age, duration of hair loss, family history of alopecia, abnormalities of menstrual cycle, multiple childbirth, dietary association, hypertension, lower ferritin) with Female pattern hair loss (FPHL).

Materials and Methods:

This was a hospital-based, case control study conducted in the Department of Dermatology and Venerology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka from March, 2021 to August, 2022. Institutional review board (IRB) approval was taken from Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. Total 100 females aged between 18-45 years were enrolled according to inclusion & exclusion criteria. Among them 30 females had history of hair loss more than 6 months, were selected from outpatient department of Dermatology, BSMMU, as case & 70 healthy females who had no complain of hair loss were included as control. Diagnosis of FPHL was done clinically, as central scalp hair loss with or without frontal accentuation with hair miniaturization and no signs of scarring alopecia. Ludwig classifications were used to assess the degree of hair loss. Information on possible risk factors for FPHL was collected using a questionnaire interview. Patients who had evidence of active infection or inflammation, who were or had been pregnant within previous 12 months, who had abnormal thyroid function results, who currently taking iron supplements due to other cause were also excluded from the analysis. Consecutive type of sampling technique was applied to collect the sample from the study population during the study period. Before enrollment of the patients into the study, the aims and objectives of the study along with its risks and benefits of this study were explained to the patients in easily understandable local language, so that they can make independent decision about their participation. All the participants were elaborately informed about the natural history and the prognosis of their disease. The patients were assured that all information and records will be kept confidential, and the study results will be helpful for both the patients and the physicians in making rational approach of the case management and control of this health issue. The patients were explained that they have the right to refuse or accept to participate in the study in its any stage and it do not hamper their treatment procedure and they will not receive financial benefit from this study. Finally, the informed written consent was taken from each of the patient. Participant data without names and identifiers were made available after approval from Institutional Review Board (IRB). All the eligible participants were participated in the study after given written informed consent. With aseptic measures 5 ml blood sample were collected for estimation of serum ferritin level and hemoglobin from all participants. Measurement of serum ferritin were done by chemiluminescence immunoassay, by Liaison XL analyzer, in the Department of Biochemistry, BSMMU. For Hemoglobin, samples were analyzed by Hematology Autoanalyzer (Sysmex XN-2000) in the Department of Laboratory Medicine, BSMMU.

Data were statistically described in terms of mean ± standard deviation (± SD) or frequencies (number of cases) and percentages. Student t-tests were used to compare quantitative variables & Chi-Square tests were used for comparing categorical variables. A level of $p< 0.05$ was considered statistically significant. Multivariate logistic regression analysis was done to assess the association of risk factors. All statistical calculations were done using computer programs SPSS (Statistical Package for Social Science; SPSS Inc., Chicago, Ill., USA) version 26 for Microsoft Window.

Results:

Table 1 shows that 43.3% patients with female pattern hair loss were in >40 years of age group with mean age 41.0±7.77 years. The prevalence of FPHL increases with age. Mean age of the healthy females of control group was 26.34±6.12 years. There were significant differences among the respondents in relation to their age.

Table -1: Distribution of study subjects by age (n=100)

Age (years)	Case (n=30) No. (%)	Control (n=70) No. (%)	P value
<20	3(10%)	17(24.3%)	
20-29	6(20%)	28(40.0%)	
30-39	8(26.6%)	21(30.0%)	
>40	13(43.3%)	4(5.7%)	
Total	**30(100.0%)**	**70(100.0%)**	
Mean±SD	41.0±7.77	26.34±6.12	0.001*
Range	18-45	18-40	

Case: female pattern hair loss; Control: healthy females with no history of hair loss

Data were presented as frequency & percentages & mean ±SD, Statistical analysis was done by unpaired student's t-test to compare between groups. $P <0.05$ considered as statistically significant.

Table II shows that most of the patients appeared after one year of starting of hair loss, 33.3% patients with FPHL came in between 25-36 months of hair loss & their mean duration of hair loss was 26.3±12.0 months.

Table -II: Distribution of patients by duration of hair loss (n=30)

Duration of hair loss (months)	FPHL (n=30) No. (%)
<12	7(23.3%)
13-24	9(30.0%)
25-36	10(33.3%)
>36	4(13.3%)
Total	30(100.0%)
Mean±SD	26.3±12.0
Range (min-max)	10-60

FPHL: Female pattern hair loss.

Data were presented as frequency & percentages & mean ±SD.

Table III shows that Grade of FPHL significantly increases with age & duration of hair loss.

Table-III: Association of Age, duration of hair loss of FPHL patients with severity according to Ludwig scale (n=30)

	Grade I (n=8)	Grade II (n=18)	Grade III (n=4)	P value
	Mean±SD	Mean±SD	Mean±SD	
Age (years)	37.32±5.34	39.12±7.62	43.45±9.31	0.041*
Duration of hair loss (months)	22.32±10.3	24.7±13.3	31.4±11.2	0.037*

Results are expressed in mean ±SD & p value. P value determined by One way ANOVA test.

P<0.05 was considered as significant

Table IV shows that, Among the patients of FPHL, 36.7% had history of inadequate intake of iron containing food, 66.7% had family history of alopecia, 36.7% had history of increased bleeding during their menstruation, 20.0% had multiple (>3) childbirth & 23.3% had hypertension. No statistically significant difference was found among the groups regarding dietary history, multiple childbirth & hypertension. Family history of alopecia, heavy menstruation was significantly higher in patients who had FPHL (p<0.001).

Table-IV: Distribution of study subjects by risk factors (n=100)

Risk factors	FPHL (n=30) No. (%)	Control (n=70) No. (%)	FPHL vs control
Dietary history			
Adequate iron intake	19(63.3%)	40(57.1%)	0.097
Inadequate iron intake	11(36.7%)	30(42.9%)	
Family history of alopecia			
Present	20(66.7%)	16(22.9%)	<0.001*
Absent	10(33.3%)	54(77.1%)	
Menstrual history			
Normal flow	19(63.3%)	67(95.7%)	<0.001*
Heavy flow	11(36.7%)	3(4.3%)	
Hypertension			
Present	7(23.3%)	10(14.3%)	0.269
Absent	23(76.7%)	60(85.7%)	
Multiple childbirth (>3)			
Yes	6(20.0%)	4(5.7%)	0.290
No	24(80.0%)	66(94.3%)	

FPHL: Female pattern hair loss ; Control: Healthy female with no complain of hair loss

Chi square ($\chi 2$) test was used to analyze the data; P<0.05 considered as statistically significant.

Table V shows that, 86.7% patients with FPHL had low serum ferritin (<30ng/ml) with mean serum ferritin level was 20.25±16.07ng/ml. 66.7% patients of FPHL had low Hb (<12 µg/l) with mean Hb was 11.47±1.52 µg/l. Low serum ferritin(<30ng/ml) & low Hb (<12 µg/l) significantly higher in FPHL group (p<0.01).

Table-V: Distribution of study subjects by laboratory findings(n=100)

Serum ferritin(ng/ml)	FPHL (n=30) No. (%)	Control (n=70) No. (%)	p-value
<30 (low serum ferritin)	26(86.7%)	14(20.0%)	
>30 (normal ferritin level)	4(13.3%)	56(80.0%)	
Mean±SD	20.25±16.07	54.37±26.07	< 0.001*
Hemoglobin (µg/l)			
<12 (low Hb)	20(66.7%)	28(40.0%)	
>12 (normal Hb)	10(33.3%)	42(60.0%)	
Mean±SD	11.47±1.52	12.15±1.37	<0.01*

FPHL: Female pattern hair loss; Control: healthy female with no history of hair loss.

Chi square ($\chi 2$) test was used to analyze the data. P<0.05 was considered as significant

Table VI shows that in the multivariate logistic regression analysis significant association were found with age, family history of alopecia, lower serum ferritin level with FPHL. Age (OR 2.013, 95% CI 0.672-3.714), family history of alopecia (OR1.231, 95% CI 0.162-1.991), lower serum ferritin (OR1.090, 95% CI 1.043-1.139).

Table-VI: Association of risk factors with FPHL by multivariate logistic regression (n=100)

Variables	β	p-value	OR	95%C.I.	
				Lower	Upper
Age(years)	1.612	0.023	2.013	0.672	3.714
Menstrual bleeding	1.97	0.005	0.183	0.056	0.603
F/O of alopecia (positive)	1.12	0.013	1.231	0.162	1.991
Hemoglobin (µg/l)	0.150	0.424	1.161	0.805	1.676
Low serum ferritin (µg/l))	0.086	0.001	1.090	1.043	1.139

Discussion:

In current study, majority of the patients of FPHL belonged to age group >40 years, with mean age was 41.0±7.77 years. Salman et al. found in their observational study that mean age of FPHL were 47.13±15.35 years[3]. Park SY et al. found mean age of FPHL were 42.9±13.0 years[7]. Raichur et al. found mean age of FPHL patients were 43 years[8]. A study conducted by Atika & Khan at Bangladesh,

reported mean age of FPHL patients were 34.18±6.57 years[5]. These findings are similar with present study. Poonia et al. stated, incidence of FPHL increased with advancing age[9]. Malkud et al also noted increased prevalence of FPHL with increasing age, from approximately 12% among women aged between 20 to 29 years to over 50% among women above the age of 8010. Su et al. also stated the prevalence of FPHL increasing with advancing age. However, increased risk for FPHL with age reflects the natural progression of this condition. Advancing age is a risk factor for FPHL in all women, regardless of their family history background [2].

In current study, majority patients with FPHL came in between 25-36 months of hair loss with mean duration of hair loss was 26.3±12.0 months. Raichur et al. found in their study, mean duration of hair loss was 33.6 months[8]. In this study 60% patients had grade II & 26.6 patients had grade l & 13.4% patients had grade lll alopecia according to Ludwig classification. A study by Atika & Khan reported 50% had grade l, 22% had grade ll & 28% had grade lll alopecia[5]. Salman et al. found most common type was grade 1 (17.2%) and the least common type was grade 3 (0.2%) in FPHL[3]. This study found that Grade of FPHL significantly depends on age & duration of hair loss. This is concomitant with the findings of Salman et al., Atika & Khan[3,5]. Zheng et al. also concluded that severity of hair loss positively correlated with duration of hair loss & age of the patient[11].

This study found no significant influence of dietary history on FPHL. Hegde & Noronha also found no significant difference in dietary history between the groups[12]. In this study family history of alopecia significantly higher in FPHL group. A Bangladeshi study by Atika & Khan showed that 44% patients with FPHL had positive family history of alopecia[5]. Malkud found positive family history in 38.8% cases in FPHL10. Salman et al. found 71.02% patients with FPHL had positive family history[3]. Zheng et al. also concluded that patient with family history of alopecia had an earlier age of onset of alopecia[11].

This study found that menstrual blood loss was significantly higher in FPHL patients. Most common cause of iron deficiency in premenopausal women was increase menstrual bleeding, which when not compensated, the level of ferritin as well as Hb dramatically decreased. This directly affects hair follicle development causing weakness & fall out. This is concordance with the study by Elethawi & Jabbar[3]. Some studies reported that frequency of hypertension increased in patients with FPHL[2]. This study found that 33% patients had hypertension. Atika & Khan reported 36% patients had hypertension[5].

In current study, majority patients with FPHL had low Hb (<12g/dl) with mean Hb 11.47±1.52 g/dl. A study by Atika & Khan reported mean Hb in FPHL patients was 12.18±1.40 g/dl[5]. Amatya et al. found mean Hb in FPHL was 12.55±1.5 g/dl[14]. Park et al. reported mean Hb in FPHL 12.94±1.2 g/d[17]. Serum ferritin is the most powerful screening tool for iron deficiency. Though, there is a wide range in level of serum ferritin, there has been controversy over the cut off level of serum ferritin, which can be defined as iron deficiency (ID), triggering hair loss. A cut-off of 30 ng/ml has a 92% sensitivity and 98% specificity in detecting iron deficiency [15].

Current study found 86.7% patients of FPHL had lower serum ferritin level (<30ng/ml) with mean SFL 20.25±16.07 ng/ml. Pradhan et al. found mean SFL in FPHL was 18.39±9.14 ng/ml in Nepal[16]. A study by Atika & Khan, found significantly lower mean serum ferritin level in FPHL with a mean SFL 12.50 ±3.37 ng/ml in Bangladesh[5]. Rasheed et al. found mean SFL in FPHL 23.9±38.5 ng/ml in Cairo[15]. These findings are similar to studies conducted by Amatya et al.; Malkud et al,[14,10] indicating low iron store could be considered as a possible contributing factor in FPHL. Few studies could not find a significant association with chronic diffuse hair loss with low serum ferritin in the studies conducted by Shrivastava et al., Agrawal et al[17,18]. The lower value observed in the present study compared to other studies is because, most of the females in present study were below 40 years and in reproductive age & had heavy menstrual bleeding. Non-inclusion of postmenopausal women, inclusion of duration of hair loss >6 months, and selection of otherwise healthy women with FPHL eliminated confounding variables.

In present study, multivariate logistic regression analysis was carried out to assess the association of risk factors with hair loss in FPHL, which showed that age, family history of alopecia & lower serum ferritin level associated with high incidence of FPHL occurrence. Age (OR 2.013, 95% CI 0.672-3.714), family history of alopecia (OR1.231, 95% CI 0.162-1.991), lower serum ferritin (OR1.090, 95% CI 1.043-1.139). These findings are consistent with the studies conducted by Atika & Khan; Rasheed et al.; Su et al[5,15,2] .

Conclusion:

Considering the findings of result it can be concluded that factors like age, family history of alopecia, and lower serum ferritin level are implicated as risk factors for female pattern hair loss.

Conflict of Interest: None.

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